30. (New) A ceramic heater according to claim 29, wherein the ceramic substrate is a carbide or nitride ceramic.

31. (New) A ceramic heater according to claim 29, wherein the ceramic substrate has a thickness of not more than 25 mm.

32. (New) A ceramic heater according to claim 29, wherein an insulating layer of an oxide ceramic is formed on the surface of the ceramic substrate and the resistance heating body is formed on a surface of the insulating layer.

33. (New) A ceramic heater according to claim 29, wherein the resistance heating body is constructed by two or more circuits.

REMARKS

Upon entry of this amendment, claims 1-18 will be canceled, and claims 19-33 will be added, whereby claims 19-33 will be pending. Claims 19, 24 and 29 are independent claims.

Applicants note that independent claim 19 is substantially a combination of claims 1 and 2, independent claim 24 is substantially a combination of claims 7 and 8, and independent claim 29 is substantially a combination of claims 13 and 14.

Reconsideration and allowance of the application are respectfully requested.

Response To Formal Matters

Applicants express appreciation for the acknowledgment of receipt of all of the certified copies in this national stage application. Applicants note however that the box acknowledging

the claim for foreign priority has apparently inadvertently not been checked. **Therefore, it is requested that the Examiner acknowledge the claim for foreign priority in the next communication from the Patent and Trademark Office.**

Applicants also express appreciation for the inclusion in the Office Action of the initialed copy of the Form PTO-1449 submitted with the Information Disclosure Statement filed March 12, 2002, whereby the Examiner's consideration of the disclosure statement is of record.

Applicants further note that the Office Action does not indicate that there are any informalities with respect to the drawings as filed with the application. Accordingly, in the absence of any indication to the contrary, Applicants will assume that no action is required on the part of Applicants with respect to the drawings.

Information Disclosure Statement

Applicants are submitting on even date herewith a Supplemental Information Disclosure Statement. The Examiner is respectfully requested to indicate consideration of this Supplemental Information Disclosure Statement by initialing the Form PTO-1449 submitted therewith, and forwarding an initialed copy of the form with the next communication from the Patent and Trademark Office.

Response To 35 U.S.C. 103(a) Rejections

Claims 1-4 and 6 are rejected under 35 U.S.C. 103(a) as being obvious over JP 11-040330 ("Masakazu") in view of JP 11-251040 (Kiyoshi"). The rejection alleges that Masakazu

discloses a ceramic heater with a substrate made of a carbide or nitride ceramic with a thickness of 0.5-5 mm and a resistance heating body formed of a plurality of circuits on a face of the substrate opposite to the heating face. The rejection admits that Masakazu does not disclose the scattering of thickness of the resistance heating body to be less than 50%. However, the rejection alleges that Kiyoshi discloses a similar ceramic heater and discloses resistance body thickness dispersion of less than 10%. Therefore, the Examiner concludes that it would have been obvious to keep the thickness dispersion as small as possible so as to have uniform temperature at the heating face.

In response, Applicants respectfully submit that independent claim 19 is directed a ceramic heater comprising a ceramic substrate and a resistance heating body formed on a surface thereof, wherein the resistance heating body is formed on a face of the ceramic substrate opposite to a heating face thereof and a scattering of a thickness of the resistance heating body is within a range of ±50% of an average thickness.

Thus, amongst the features recited in independent claim 19, claim 19 is directed to a resistance heating body which is formed on a face of the ceramic substrate opposite to a heating face thereof, whereby the distance between the heating body and the heating face can be sufficiently ensured. Therefore, heat produced from the heating body can be transmitted and diffused into the ceramic substrate to improve the temperature uniformity of the heating face. However, Applicants have confirmed that a non-uniform portion may be existent in the heating face. As a result of the analysis on this phenomenon, it has been found that a scattering in the

thickness of the resistance heating body is caused and hence the scattering in the resistance value is caused to produce different heat generating amounts in places of the heating body.

Amongst the features recited in independent claim 1, it is recited that scattering of a thickness of the resistance heating body is within a range of ± 50% of an average thickness. This combination of features enables the heat generating amount to be made more uniform by adjusting the scattering of the thickness of the heating body itself to ± 50% of an average thickness, so that the temperature uniformity of the heating face can be further improved.

To further understand this aspect of Applicants' invention, attention is directed to Example 1 and Comparative Examples 1 and 4. Comparative Example 1 is an experimental example corresponding to Masakazu. In Masakazu, Solvest is adopted as a conductive paste. In Example 1, scaly metal particles are used to reduce the scattering of thickness. The scattering of thickness in Comparative Example 1 is 55%, while that of Example 1 is 15%. Also, the scattering of temperature in the heating face is 10°C in Comparative Example 1 and 5°C in Example 1, respectively. Therefore, Example 1 is superior to Comparative Example 1.

Comparative Example 4 is concerned with an inner layer heater, in which the scattering of temperature is 13°C, which is inferior to Example 1. In the inner layer heater as described in comparative Example 4, the distance between the heating body and the heating face is short, so that. a high temperature zone similar to the pattern of the heating body is apt to be easily produced in the heating face.

Thus, the present invention solves the problem inherent to the invention of Masakazu , and is not taught or suggested by Masakazu.

Kiyoshi is concerned with the inner layer heater, which corresponds to Comparative Example 4. Therefore, Kiyoshi is entirely different from the present invention. There is no suggestion or motivation to employ the element on the surface with the scattering of the thickness of the resistance heating body of Masakazu, which is on the top of the heater, much less to employ the range as recited in the present claims.

Akai discloses a technique that an insulating layer 23 is formed on a ceramic substrate 22 such as BN and further a heating body 26 is arranged thereon. However, Arai does not disclose nor suggest the scattering of thickness in the heating body.

Accordingly, Applicants respectfully submit that the prior art of record does not teach nor suggest Applicants' disclosed and claimed invention, whereby the rejection should be withdrawn, and each of the claims indicated to be allowable.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Masakazu in view of Kiyoshi as applied to claim 1 and further in view of U.S. Patent No. 5,591,269 to Arami et al ("Arami"). The rejection admits that Masakazu does not disclose the resistance heating body formed on the insulating layer. However the rejection alleges that Arami discloses a resistance heating body formed on an insulating layer. From this, the rejection asserts that it would have been obvious to provide a heating resistance body on top of insulating layer so as not to have short circuiting, specially at high temperature when the resistance of the ceramic base gets low.

In response, Applicants note that independent claim 24 is directed to a ceramic heater comprising a ceramic substrate and a resistance heating body formed on a surface thereof,

wherein the resistance heating body is formed on a face of the ceramic substrate opposite to a heating face thereof and a surface roughness of the resistance heating body is within a range of 0.05 μm - 100 μm as Rmax and not more than 50% of an average thickness of the resistance heating body.

Thus, similar arguments as with respect to independent claim 19 apply to independent claim 24. Moreover, in independent claim 24, amongst other features recited therein, there is recited a surface roughness of the resistance heating body is within a range of 0.05 μm - 100 μm as Rmax. This permits the removal of heat in the atmosphere gas around the heating body to be adjusted and the scattering of heat generation amount in the heating body to be controlled to uniformize the temperature of the heating face.

As disclosed in Applicants' originally filed application, beginning at page 4, line 3, when the surface roughness of the resistance heating body is less than 0.05 μm as Rmax, the surface is too smooth and an atmosphere gas is easily fluidized and locally gets heat of the resistance heating body and hence the temperature of the heating face for the wafer or the like becomes easily ununiform. While when the surface roughness exceeds 100 μm as Rmax, the thickness of the resistance heating body becomes scattered and the temperature of the heating face for the wafer or the like becomes ununiform. That is, when the surface roughness of the resistance heating body is too large or too small, the temperature of the heating face can not be uniformized.

In other words, it is disclosed that the reason the scattering and surface roughness of the thickness of the resistance heating body are adjusted is to prevent the fact that when they exceed upper limits, the scattering of the resistance value of the resistance heating body becomes large

and hence the scattering of the temperature distribution of the heating face for the wafer or the like becomes large. Thus, when the surface roughness is less than 0.05 μm, the atmosphere gas is too fluidized to take heat and hence the drop of temperature is caused. However, when it exceeds 100 μm, the scattering of thickness in the heating body becomes large and the non-uniformity of temperature in the heating face is caused. This is understood from the comparison of Example 1 with Comparative Examples 2 and 3. Rmax of the heating body is 0.5 μm in Example 1 and 130 μm in Comparative Example 2 and 0.04 μm in Comparative Example 3, respectively. Hence, the scattering of temperature in the heating body is 5°C in Example 1, 15°C in Comparative Example 2 and 10°C in Comparative Example 3, respectively. From these results, it is clear that the scattering of temperature in the heating face is controlled in Example 1.

As mentioned above, the invention recited in independent claim 6 further improves the uniformity of temperature in the heating face by adjusting the surface roughness of the resistance heating body. In Comparative Example 1 corresponding to Masakazu, Rmax with respect to the average thickness of 5 μm is 3.5 μm, so that Rmax exceeds 50% of the average thickness (2.5 μm). Further, Masakazu does not teach nor suggest the adjustment of the surface roughness of the heating body at all.

Kawada discloses the heating body of Rmax is 5 μm, at column 4, line 37, but does not teach nor suggest the adjustment of Rmax with respect to the thickness of the heating body at all. Further, Kawada does not recognize that the scattering of temperature of the heating face becomes larger when Rmax exceeds 50% of the thickness.

Moreover, while Arami discloses the use of an insulation layer in a vacuum processing apparatus, there is no suggestion or motivation to combine Arami with Masakazu and Kiyoshi. The alleged motivation in the rejection, "so as not to have short circuiting, specially at high temperature when the resistance of the ceramic base gets low", is based upon improper hindsight.

Accordingly, Applicants respectfully submit that the prior art of record does not teach nor suggest Applicants' disclosed and claimed invention, whereby the rejection should be withdrawn, and each of the claims indicated to be allowable.

Claims 7-10, 12-16 and 18 are rejected under 35 U.S.C. 103(a) as being obvious over Masakazu in view of Kiyoshi and JP 07307377 ("Kawada"). Regarding claims 7-10 and 12, the rejection alleges that Masakazu and Kiyoshi disclose all the recitations of these claims but admits that they do not disclose that the surface roughness of the resistive heating body is to be 0.05-100 μm. However, the rejection alleges that Kawada discloses a surface roughness of a heating layer on a ceramic heater being greater than 5 μm. Regarding claims 13-16 and 18, the rejection also alleges that Masakazu and Kiyoshi disclose all the recitations except that they do not disclose that the surface roughness of the heating body is less than 50% of its average thickness. However, the rejection alleges that Masakazu discloses the average thickness of the resistance body to be 1-20 μm and with a 50% maximum, the roughness may be 0.5-10 μm. The Examiner further alleges that this falls within acceptable disclosed level of roughness in the claim as well as in Kawada. Therefore, the Examiner concludes that it would have been obvious to have the

surface of the heating body rough so that it may have good bonding with the base and cool quickly after the heating is turned off.

In response, Applicants note that independent claim 29 is directed to a ceramic heater comprising a ceramic substrate and a resistance heating body formed on a surface thereof, wherein the resistance heating body is formed on a face of the ceramic substrate opposite to a heating face thereof and a scattering of a thickness of the resistance heating body is within a range of ±50% of an average thickness and a surface roughness of the resistance heating body is within a range of 0.05 μm - 100 μm as Rmax and not more than 50% of an average thickness of the resistance heating body. is directed to a ceramic heater comprising a ceramic substrate and a resistance heating body formed on a surface thereof, characterized in that the resistance heating body is formed on a face of the ceramic substrate opposite to a heating face thereof and a scattering of a thickness of the resistance heating body is within a range of ±50% of an average thickness and a surface roughness of the resistance heating body is within a range of 0.05 μm - 100 μm as Rmax and not more than 50% of an average thickness of the resistance heating body.

Thus, in independent claim 29, the scattering of thickness in the resistance heating body is made within a range of ±50% of the average thickness in addition to the features of independent claims 19 and 24. In this case, the heat generation amount of the heating body is made even further uniform. This is understood from the comparison of Example 1 with the Comparative Examples. In Example 1, the scattering of thickness is 15% of the average thickness, and the surface, roughness of the heating body is Rmax = 5 and the scattering of temperature in the heating face is 5°C.

In Comparative Example 1, the scattering of thickness is 55% of the average thickness, and the scattering of temperature in the heating face is 10°C. In Comparative Example 3, the scattering of thickness is 0.8%, but Rmax is 0.04 μm, so that the scattering of temperature in the heating face is 10°C.

In Comparative Examples 5 and 6, Rmax is 3.6 μm and 3.5 μm, respectively, but the scattering of thickness is 55%, so that the scattering of temperature in the heating face is 10°C and 6°C, respectively.

As seen from the above, the invention recited in independent claim 29 further improves the temperature uniformity of the heating face by adjusting the scattering of thickness in the heating body.

Still further, Applicants note that claims 11 and 17 are rejected under 35 U.S.C. 103(a) as being obvious over Masakazu in view of Kiyoshi and Kawada as applied to claims 7 and 13 and further in view of Arami. The rejection admits that Masakazu does not disclose the resistance heating body formed on the insulating layer but alleges that Arami discloses a resistance-heating body formed on an insulting layer. The rejection then concludes that it would have been obvious to provide heating resistance body on top of insulating layer so as not have short circuiting specially at high temperature when the resistance of the ceramic base gets low.

Applicants note that this ground of rejection is not appropriate for the reasons previously set forth above, and for the sake of brevity the arguments are not being repeated.

Accordingly, the rejections of record should be withdrawn as improper, and all of the claims should be indicated as allowable.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejection of record, and allow each of the pending claims.

Applicant therefore respectfully requests that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Any amendments to the claims which have been made in this amendment, and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed attached thereto.

Should the Examiner have any questions regarding this Response, the this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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